

DOCUMENT RESUME

ED 130 629

IR 004 161

AUTHOR Zinov'yev, S. I.
TITLE Programmed Instruction and Certain Pedagogical Problems (USSR).
INSTITUTION Joint Publications Research Service, Washington, D.C.
REPORT NO JPRS-24,065; TT-64-31006
PUB DATE 7 Apr 64
NOTE 11p.; Archival document

EDRS PRICE MF-\$0.83 HC-\$1.67 Plus Postage.
DESCRIPTORS *Educational Problems; *Programed Instruction; Reinforcement; Teaching Methods
IDENTIFIERS *USSR

ABSTRACT

In the Soviet Union, data were gathered which testify to the effectiveness of teaching machines and other automated devices, especially for the instruction of strict systems of scientific knowledge. The psychological and pedagogical value of automated teaching aids is, however, in some instances questionable, particularly when programs are based on behavioralist notions of reinforcement. Two shortcomings of teaching machines are: (1) that technical designers fail to account for a broad range of human factors that determine optimal learning conditions, and (2) that the learner is taught to depend on the machine. It should also be remembered that many materials are just as effectively delivered via traditional textbook methods. (EMH)

* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *

ED130629

JPRS: 24,065

TT: 64-31006

7 April 1964

PROGRAMMED INSTRUCTION AND CERTAIN
PEDAGOGICAL PROBLEMS

by S. I. Zinov'yev

- USSR -

U. S. DEPARTMENT OF COMMERCE

OFFICE OF TECHNICAL SERVICES

JOINT PUBLICATIONS RESEARCH SERVICE

Building Tempo E

East Adams Drive, 4th & 6th Streets, S.W.
Washington, D. C. 20443

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

I-N; II-G

TR 004161

PROGRAMMED INSTRUCTION AND CERTAIN PEDAGOGICAL PROBLEMS

Following is the translation of an article by S. I. Zinov'yev in the Russian-language periodical Vestnik vysshey shkoly (Herald of the Higher School), Moscow, No 12, 1963, pages 45-51.

Programmed instruction with the use of teaching machines and other cybernetic mechanisms and also programmed textbooks lately are attracting the attention of an increasingly wide circle of teachers in higher educational institutions. Considerable data on the practical application of these new educational devices has accumulated; among the first to use these devices were the Moscow Power Engineering Institute and the Academy of Pedagogical Sciences of the RSFSR.

Research and design work in this area is conducted by many higher educational institutions. A programmed textbook on theoretical mechanics being tested in practice at the Moscow Polygraphic Institute; examinations -- with use of machines -- for a large number of students were conducted at the Lvov Polytechnical Institute. A large program of investigations is outlined and is being carried out at a number of departments of Moscow University. Interesting work is conducted at the Moscow State Pedagogical Institute of Foreign Languages and Kiev University as well as in Moscow State Pedagogical Institute im. V. I. Lenin, which are applicable to secondary school. The most significant results were attained in this area by the Moscow Power Engineering Institute and the Kiev Higher Engineering Radiotechnical School.

Here we have mentioned on certain vuzes working in programmed instruction whose experiments are the best known; the list, however, could be continued.

The role, meaning and place of programmed instruction in the educational process of the higher school is still difficult to evaluate with the necessary completeness and versatility, but even now it is possible to say that it possesses great potential for the organization of the educational process on a new basis, with reference to individual learning peculiarities. As experience showed, programmed instruction allows us to resolve such complicated pedagogical problems, as development of self-reliance in the educational process, the gradual assimilation of a strict system of scientific knowledge, etc. (of course, if the program is developed, taking into account the psychological-pedagogical peculiarities of instruction and in full conformity with the problems of higher education, and also if the learner shows an interest in instruction).

By itself the creation of a program with a thorough selection of scientific material and its strict logical construction has great meaning for the educational process, whether programmed instruction will be used or whether the program will serve as a basis of teaching using the conventional system.

Certain types of teaching machines and cybernetic mechanisms can be already now be used in the educational process especially when this is connected with the development of certain practical skills in students of technical, physical, and mathematical disciplines which must be studied in strict sequence. Furthermore, teaching machines can be applied for self-checking of students engaged in independent work and for checking on their knowledge. "Examiners" of various types -- practically the most widespread of all the new teaching means -- is attracting much attention.

This is explained, apparently, by the fact that the practical of the machine and its training problems turned out to be evident for designers and to be the most accessible from an engineering viewpoint. Of course, this does not mean that "examiners" have been completely perfected; not at all -- they need to be improved with regard to a number of psychological-pedagogical requirements; this is also true of other machines and teaching devices. The accuracy and "infallibility" of the appraisals of machines from a pedagogical point of view is still disputed by certain pedagogues and is regarded as conditional.

The deficiencies in teaching machines the imperfections in many, it is possible to explain by the fact that they were most frequently created by technicians without the participation of psychologists, pedagogues, and other scientists. Technical thought in the given case outstripped consideration of representatives of other branches of scientific thought. Meanwhile, precisely these considerations must serve as the basis for determining the principles for designing teaching machines.

Teachers abroad turned out to be in the same position. "National Education workers are suddenly attacked by the engineer of the XX century", -- observes American scientist D. Finn in an article "The New Conception of Technology in Instruction".

The same is true of present programmed training aids: thus far, they lack deep scientific psychological-pedagogical foundations. Moreover, programmed training aids are being created by many authors; various training demands are made on them, general demands to make of them are not clear. There still remains a great deal to do in this area; the material already accumulated can serve as a firm basis for this work.

At the same time, one would note that we cannot and should not mechanically slot programmed instruction from other countries to our country since the targets and problems of higher education, and consequently the way, methods and means of solving them are different from those in other countries, particularly the United States.

Above all, Soviet pedagogy cannot accept the principles of the pragmatic theory of J. Dewey and behavioral psychology upon which American scientists attempt to base programmed instruction. American scientists for example,

B. Skinner, in attempting to find the most expedient ways the solution of problems of programmed instruction incorporate into their basis experiments on developing certain skills in pigeons, thus ignoring the originality of human personality and peculiarities connected with the instruction of humans; and this depreciates the techniques and methods they offer. Not accidentally do many American scientists connect instruction by the programmed system with reward and punishment of the learner. Thus, they believe that to inform the student immediately of the result or the evaluation of his work constitutes a reward. They even propose to reward children giving correct answers with, e.g., a coin a piece of pie, etc. Such "pedagogy" is not acceptable to us.

In general, the United States has not created a scientifically-proved theory of programmed instruction and many methods applied there, from our point of view, are without pedagogical foundation and scientific confirmation. As showed by a symposium, conducted in the United States in the summer this year, American scientists themselves admit that they still have not developed the scientific and theoretical questions of programmed instruction and they only are planning to do so.

Apparently, with this is connected one of the most important deficiencies in the American system of programmed instruction (in any case in many types of teaching machines applied there), i.e., that it, as a rule, does not stimulate thinking in the student, it does not assume the deep analysis of scientific questions, although, as experience shows, technology can solve this problem.

The foregoing does not mean, however, that we have to completely reject the experience of programmed instruction carried out in the United States. Certain technical devices created there as well as certain techniques and methods of teaching -- tested in actual practice -- present some interest. For example, it is pedagogically justifiable to gradually increase the difficulty of assignments to the students. Certain American pedagogues are correct in insisting that the student supply his own answer instead selecting a multiple choice answer. But on the whole, the American system of programmed instruction cannot be considered satisfactory.

On the way to the practical introduction of programmed instruction in the higher school, there are a great many difficulties of a psychological-pedagogical, and technical character. It would seem that for the further movement motion forward, it is necessary to check and to comprehend everything starting with the very terms: "programmed instruction", "programmed textbook" and "teaching machines". This, certainly, is not the main problem, but psychologists, teachers and philosophers argue about these names, since they do not reveal the essence of the matter. We concur with the remark that the machine, in general, cannot (or more accurately should not) be called a "teaching" machine, since the process of instruction of person by person and person by machine -- no matter how perfected the latter may be -- differ in essence and in results.

Further, the united efforts of psychologists, pedagogues, hygienists, philosophers, mathematicians, specialists in the area of higher nervous activity, cyberneticists, radio engineers, television engineers, experts in training films, polygraphy, etc. are necessary for the creation of methods of applying modern technical devices and for the resolving of the problem of programmed instruction in all its aspects. This is work on a large scale and obviously of long-term significance. So that it might be successful, it is necessary first of all, to reveal with necessary fullness both Soviet and Foreign experience in this area, to analyze it scientifically, to give it a manifold scientific appraisal and, on this basis, to settle on long-term goals so as to move further in the development of the problem. Such a problem can only be solved by collectives of scientists working in various specialties.

The increased interest in programmed instruction and especially in teaching machines has caused a wave of creative work on the part of many scientists and specialists. However, the prevailing technical opinion is that sometimes a teaching machine or other cybernetic mechanism is created and then people start to think and to test it to determine its usefulness in education; and it turns out that the technical characteristics of the machines are definite, while their educational potential is vague. Individual designers, as experience has shown do not even notice this.

Thus, at one of many conferences on this question a well-known designer of electronic machines — in answering a question similar to the remark, mentioned above, answered: "The machine can do anything!" In reply, people properly objected that the potential of the man who created the program for this machine were still limited and that the teaching machine cannot do everything.

In starting work on a teaching machine, the designer, in our opinion, should by all means receive a "pedagogic order" and to work jointly with pedagogues and psychologists. Teachers are obliged to tell him the purpose for which the teaching machine is needed, the kind of educational problems it should resolve and what kind of methods are applicable. This seems very elementary and it would not be necessary to discuss this point were it not for the actual results.

The conclusion is to: create teaching machines only in those cases where it is really necessary, where they will resolve new educational problems which cannot be resolved by known pedagogic means, or will help to improve the educational process, i.e., to improve the quality of preparation of students or to accelerate the process of instruction without lowering its quality. And there is no necessity to program all disciplines or all their divisions; frequent it is possible to study a subject by simple methods, with the help of an ordinary textbook, etc. Apparently, in the higher educational institution, it is possible to combine the usual forms of educational work with programmed instruction, while retaining the systematic textbook and systematic work under a teacher. Assuming that it is useful in certain

divisions of the most complicated disciplines of a physical and mathematical or technical character which lend themselves to programming, to the use of programmed means of instruction, we must still stipulate that it will give the best educational results as compared with the usual forms of educational work.

What kind of place will conventional methods and means of instruction occupy under the more or less widespread application of teaching machines? If machines are included in the educational process, it will be necessary to examine the system of teaching, the role of the teacher will change as will the independent work of the students. But we believe it is still too early to discuss this -- it is necessary to have in sufficient quantity machines completely corresponding to psychological-pedagogical requirements and the educational problems of the higher school. But at any rate, the teaching machine will not replace the teacher.

In the present stage of development of technology, the teaching machine should be included in the existing system of instruction as one of the teacher's technical means of instruction. At the same time the machine should help the student in his independent work but should in no measure compromise his independence or initiative, but rather, assist in the development of these qualities. Therefore, in our opinion, we should strive primarily to create a machine for independent work by students.

The "examiners" and "tutors" in which designers are so interested -- are not the entirely essential; they, obviously, can execute auxiliary work. First of all, apparently, are needed "stimulating-reacting mechanisms", which would give the students the necessary scientific information and simultaneously develop their activity. Besides one should pay special attention to the method of resolving these problems, since in a pedagogical sense, the most valuable is still that activity, which is developed on the student's own initiative, without external influence, and prompting, etc.

Teaching machines (if widely used) can have special meaning for correspondence students: working with them at training and consultation points, correspondence students would receive new systematic knowledge, would be "quizzed", could quiz themselves, etc. Correspondence education would thus receive reinforcement, teaching machines could be applied along with other contemporary technical means and textbooks of the usual type containing a systematic presentation of material.

One of main problems, which, in our opinion, must be solved by means of programmed instruction -- in particular by means teaching machines -- is the more expedient selection of educational data from the infinite flow of facts delivered to us by modern science and technology. This will help to resolve a very important pedagogical problem -- to create a logically irreproachable system of knowledge discarding the superfluous and considering the probable difficulties of students in their independent work.

But it is still more important that the teaching machine-help as much as possible in individualizing educational work not only in educational targets, but also in accordance with the scientific interests of the students, in expanding for them the possibility to develop independence, initiative, quick-wittedness and creative tendencies. Such a machine will occupy a proper place in the system of higher education.

Why do certain of our scientists doubt the usefulness of the system of programmed instruction and, in particular, teaching machines for the higher school? Apparently because many contemporary teaching machines produce a dual impression: on the one hand, there are striking possibilities which have been discovered and used, but on the other--one still encounters the primitive resolution of important psychological-pedagogical with the help of these machines. This refers to the uncompletedness of the actual system of programmed instruction and, in a number of cases, generates mistrust in it. After all, for the majority of pedagogues, who are unfamiliar with electronics and cybernetics, it is not clear whether deficiencies in the machines have been eliminated and in what measure it is possible to improve such machines.

Some pedagogues note, for example, that independence in the work of students with the use of a number of the early teaching machines is only surface, apparent: the machine "guards" student, the student too much; it not only leads him, but really "drags" him, needlessly slipping him infinite promptings, not letting him actually think and solve the problem himself.

Whatever the form of instruction, whatever the means used by the teachers, we cannot and should not forget the specific problems peculiar to the higher school. It is important, that designers not lose sight of this in creating teaching machines. They should strive to observe pedagogic principles which have been proved in practice. Of course, this does not mean that we should hamstring ourselves in the search for new ways and means of instruction; we are obliged all to test and investigate and to take only that which completely corresponds to the complicated problems of higher education.

In already existing and utilized teaching machines and in programmed textbooks, it is necessary to remove deficiencies of a pedagogical character. It is scarcely expedient, to divide courses up into excessively small portions as has been done in some instances here and as a rule, in the United States, inasmuch as this disturbs the logic/logician of the subject and the student is trained "to be fed" small doses, not embracing the subject as a whole. Pedagogically, it is more expedient to divide the material into logically complete parts, which, of course, will be of various magnitude. Furthermore, there should be a durable logical connection between them. Otherwise instruction is reduced to simple memorization. This would be all right if the material were properly understood, but the possibility of mechanical memorization is not excluded.

But the idea of dividing educational material up into small portions has so gripped the specialists who are developing teaching machines and programmed textbooks that certain even of them claim that logical connection between separate portions of educational material is not obligatory. Quite recently one teacher at a technical college attempted to prove that programmed instruction materials should be in three degrees of difficulty. The first degree refers to portions of materials in which the logical connection is completely removed. Such material, in his view, should be given to the strongest students; they have to be trained in the technique of mastering the material. For average students it allows the preservation of some manner of logical connection between separate portions of the educational information, and only for weak students is it considered permissible to preserve logical connections entirely, i.e. what amounts to the normal study of the discipline. He even indicates the way to implement these ideas.

How can such a tendency to artificially complicate the process of learning a science in higher educational institutions be explained. Apparently only by a lack of information about pedagogy and psychology, since it is well-known logical connections and the general comprehension of all educational materials and its ideological direction always makes the understanding and mastering of the material. Let us consider certain other questions connected with programmed instruction.

Skinner and his adherents in the United States affirm the necessity for the immediate reinforcement of knowledge and skills which a student receives; a delay of even several seconds lowers the degree of comprehensibility. As a result the programs and programmed training aids composed by these teachers, at every step contain various prints, reminders and other means of "reinforcement". In our opinion, any kind of reasonable, psychologically- and pedagogically-justified reinforcement in the independent work of student, and in certain complicated disciplines -- more accurate, in their questions separate, -- is necessary. But one should not give such "reinforcement" in any case, on the principle "perhaps it will be needed", "this is more correct", etc. In this way one can only spoil matter, and bring to nought the independence of students and deprive them of their capacity for a serious, truly independent approach to things and the development of their thinking processes. The student is not a child; he himself usually knows when he needs help; this is when he should be helped. Besides knowledge, the student must have the required skill to find necessary material, the necessary reference book. After all, after graduation from a higher educational institution, the student cannot drag a teaching machine around to solve reference questions. The conclusion is simple: in programming educational materials and in anticipating possible difficulties for students, one should not remove these difficulties by a simplified method, one should not give ready answers and recipes. Psychologists, teachers, and method workers together with specialists in cybernetics and in other areas of science must find the way to resolve this problem, bearing in mind the learner possesses individual peculiarities.

It is true, that the process of individualizing educational work is to some extent enhanced by work with teaching machines and programmed textbooks, but this is clearly insufficient. The degree of preparation of students, their skills, habits, character, strivings and study motives are so varied that it is difficult to outline the most whole expedient ways of instruction. However this it is necessary: otherwise a stereo type inevitable. Pedagogue should know his own pupils well, in order to successfully direct them and the teaching machine and programmed textbook should "anticipate" peculiarities of students and present them the most rational, optimal ways and methods of working.

In process of self-checking, the students are presented multiple choice answers, all or some of which are incorrect. How useful is this from a pedagogical point of view? We feel that it is not useful: we cannot forget that this method makes the knowledge of students unstable, it generates uncertainty in them. Moreover, it is still unknown which tends to stick more durable in the memory -- the correct of the incorrect answer. In instruction we have to proceed from the positive and not from the negative. This is reinforced by all the experience of the Soviet school and nothing forces us to change this point of view. Technically, it is possible to eliminate this deficiency and in many machines this is being done, although in our opinion, not with sufficient success.

We consider it pedagogically more justified the requirement to resolve example, problem, to construct a diagram or a graph, to give a written answer to a question, etc. Then the student will show greater activity, independence and conscientiousness and develop his ability to work. But one should also use these means in moderation: it is impossible to force a student to pass through all stages of work without exception. Is it really bad, if guesses, comprehend, and anticipates the solution of the problem with lightning speed, and maybe uses his own unique method? We must also develop in students these precious qualities, together with skills deriving from persistent systematic work and in building teaching machines and programmed textbooks, we must consider this problem along with others. Those who master course material should receive the right and possibility to "skip" through certain programmed stages of the work.

In the discussion of programmed textbooks most quarrels center on the question of system of construction, the arrangement of educational material, the character and dimension of separate "portions" and the kind of questions used for self-quizzing. Although programmed manuals are even now being developed by many scientists, the requirement are still not determined; their psychological-pedagogical basis still is still forming.

Maybe, the most effective will be a "combined" textbook in which all information will be presented by the usual system while individual section -- the most difficult to master and at the same time easy to program -- will be in the form of programmed instruction; possibly it is expedient to make

a programmed enclosure to the usual textbook. This would save students from having to master the simplest scientific data in drawn out and sometimes complicated form. Apparently, in textbooks for certain, disciplines the programmed system can predominate and in certain cases it may be expedient to make use of a programmed textbook along. In resolving all these questions it is necessary to consider not the external side in the selection and arrangement of material, but the essence of the course, its peculiarities, its difficulty and its methods. Without this no system will yield positive results.

Editor's note: In publishing S. I. Zinovev's article, the editors' office feel that some of the ideas expressed by him are debatable. However, the necessity to ponder the pedagogical aspects of the programmed instruction system is evident.

CE-59
CSO: 1872-D

- END -